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Patentanmeldung Nr. | Patent application No. | Demande de brevet n°

00201237.5

Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
p.o.

I.L.C. HATTEN-HECKMAN

DEN HAAG, DEN
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Sheet 2 of the certificate
Page 2 de l'attestation

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Access to a havi network through the internet

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Access to a HAVi network through the Internet

The invention relates to accessing an in-home network, in particular a HAVi based network, from a remote device, specifically via Internet.

With the arrival of new in-home network technologies, such as IEEE 1394 and Bluetooth, the likelihood of a broad use of such networks for communication between CE devices, in particular Audio/Video devices, has increased. For CE devices, focussing on A/V, the higher level protocols (application protocols) have recently been described by HAVi (Home Audio/Video interoperability architecture). The success of wide area networks, in particular Internet and mobile phone systems, has led to a desire to access in-home networks from remote locations. This would, for instance, enable a user to program his home VCR from his office PC or to view a security camera on a WAP phone. It is known to provide remote access to an in-home network via an intermediate device, usually a PC, which is equipped with interfaces to both the in-home and the wide area network. In a situation where both networks provide the same application protocols, the intermediate device plays the role of a bridge or of a router. In a situation where the application protocols are different, the intermediate device also converts the application protocols of the wide area network to those of the in-home network and vice versa. Such a device is usually referred to as a gateway.

In the case of connecting an in-home network, like HAVi, to a remote Internet device, such a remote device is not equipped with HAVi protocols, nor with application programs, such as HAVi applets, for controlling HAVi devices. It is desired that HAVi devices can be controlled from remote devices, like an office PC or a WAP phone.

It is an object of the invention to enable communication from a remote device to devices in an in-home network in a user-friendly manner. It is specifically an object to provide a method and communication system wherein the communication between the remote device and the in-home network can be established with little involvement of the user.

To meet the object of the invention, a communication system includes an in-home network and a remote device;

the in-home network including a plurality of in-home devices operative to communicate using a predetermined in-home application protocol; one of the in-home devices, being referred to as intermediate device, also being operative to communicate with the remote device; the intermediate device and the remote device using communication protocols, referred to as remote protocols, which differ from the in-home application protocols;

the remote device being operative to:

load a portable application program for controlling at least one of the in-home devices using the in-home application protocol;

load an API emulator operative to:

emulate an API which provides an interface for the application program at least for those functions of the in-home application protocol that are used by the application program; and

communicate with a module in the intermediate device;

the intermediate device including an API which provides interface functionality for at least those functions of the in-home application protocol that are used by the application program; the interface functionality being provided by controlling the intermediate device an/or communicating with other in-home device(s) according to application messages of the in-home application protocol; the intermediate device being operative to load the module for enabling communication between the API emulator in the remote device and the API loaded in the intermediate device, establishing a substantially transparent communication path between the portable application program in the remote device and the API in the intermediate device.

In this way, the portable application program developed for use in the in-home network, and usually already present in this network and familiar to the user, can be simply loaded in the remote device. Consequently, the same functionality and the same user interface also get available outside the in-home network.

These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments shown in the drawings.

Figure 1 shows a block diagram of the system according to the invention,

Figure 2 shows the prior art protocol architecture and the architecture according to the invention, and

Figure 3 shows a subdivision in HJA parts.

Detailed description

Figure 1 shows a communication system 100 according to the invention. The system includes at least one device 110, referred to as remote device, connected via a wide area network 120 to a device 130 on the in-home network 140. This device 130 is referred to as intermediate device. Shown are two further devices, 150 and 160, on the in-home network 140. The system will be described in more detail for the situation wherein the wide area network is Internet, and the in-home network is HAVi operating on top of the IEEE 1394 bus. It will be appreciated that also other wide area networks may be used. Similarly also other in-home networks may be used. In principle, instead of a wide area network 120 also a second in-home network may be used. In such a scenario, two different types of in-home networks are coupled via the intermediate device 130. This scenario will not be described further. Instead the focus will be on accessing the in-home network from a remote device across the Internet. Since information on communication systems like Internet, 1394 and HAVi is generally available, no detailed description is given of the functionality (hardware and/or software) required for those systems.

Figure 2A shows an outline of the prior art protocol stacks. The remote device 110 includes conventional Internet protocols, like TCP/IP 210. These protocols include also the lower level telecom protocols, like V90, which are not shown. The intermediate device includes a corresponding Internet protocol stack 230. In addition it supports the communication protocols for communication via the in-home network 140. Shown are the 1394 protocols 232 (usually mainly implemented in hardware) and the HAVi protocols 234. At least one of the devices in the in-home network can be controlled by an associated application program, written in portable code, like Java. The application program communicates with the associated device using application protocol messages specific for the in-home digital network. If the program is coded in Java, it is usually referred to as an applet. In line with this, an applet designed for communicating using HAVi application protocol messages is referred to as Havlet. In the example described here in detail, the application program is a HAVi Java Applet (Havlet) sending/receiving HAVi messages via calls to the HAVi Java API (HJA), where API stands for Application Program Interface. HJA is a set of Java classes and packages whose interfaces and behaviour are defined by the HAVi standard. It concerns two things:

- Providing a way to present a user interface (HAVi Level 2 UI), i.e. the packages org.havi.ui and org.havi.ui.event.
- Providing access to the different HAVi infrastructure elements (system and non-system software elements), i.e. all packages except org.havi.ui and org.havi.ui.event.

Havlets are the HAVi equivalent of the Java Applet concept. They can be uploaded to a HAVi FAV (Full A/V device) with a display. Those FAVs have to provide (their own implementation) of the HJA, so the Havlet may assume those classes to be available.

The portable application program (Havlet) may be located in the device it controls (referred to as associated device) or may access this device via the in-home network. The HAVi protocols can be accessed via the HJA interface 236 as shown in Figure 2A. This interface enables the Havlet 238 to communicate with the other devices in the in-home network 140. Of course, if the Havlet 238 controls the same device as on which the Havlet is being executed, then the HJA ensures that the instructions issued by the Havlet are executed by the device. The proprietary way of locally executing the HJA functions is not shown. Further one more in-home 150 is shown with corresponding 1394 protocols 252 and HAVi protocols 254. Not shown is the proprietary way of executing any HAVi messages by the device 150.

Figure 2B shows an outline of the protocol stack according to the invention. The Havlet 238 is now loaded into the remote device 110. It is assumed that the remote device can execute the Havlet. This is the case for a conventional Internet device equipped with a browser capable of executing or interpreting Java applets. In addition, the specific HAVi functionality, accessible via the HAVi Java API (HJA) needs to be made accessible for the Havlet on the remote device 110. To this end, a HJA emulator 310 is loaded on the remote device 110. It offers the HJA interface to the HAVi applet 238. Unlike the real HJA layer 236 as shown in Fig. 2A, the HJA emulator 310 does not issue HAVi messages directly to a HAVi device. Instead, The HJA emulator 310 ensures that the interaction between itself and the Havlet 238 results in a same interaction with the real HJA 236, which actually provides the functionality. So, the HJA emulator 310 'mimics' the HJA layer 236 by reporting the fact that HJA was called by the HAVi applet 238 and details about the call (like parameters) to the intermediate device 130. The intermediate device 130 is loaded with an additional module 330 which retrieves the information supplied to it by the HJA emulator 310 and issues the corresponding call to the HJA interface 236. This will normally result in message(s) being sent to a HAVi device. It will be appreciated that information/messages from a HAVi device will be transferred back in reverse sequence. Preferably the exchange of

information between the HJA emulator 310 and the module 330 takes place via standard Internet protocols, like using TCP/IP. Advantageously, the information to be passed on to the intermediate device 130 is embedded in XML messages, using the SOAP technique of Microsoft, which enables embedding an API in XML messages and as such establishing a form of remote procedure calling mechanism. In such a system, the module 330 retrieves the API information from an XML message and calls the HJA 236. In the reverse sequence, the module 330 is triggered by the HJA 236 and embeds the supplied information in an XML reply message which is sent to the HJA emulator 310. The module 330 can also pass on information, like events, sent by the controlled device in an asynchronous manner. Also this information is packed in XML messages. The HJA emulator 310 in response to receiving an XML message triggers the Havlet 238 as if it had been directly triggered by the HJA 236.

In a preferred embodiment, the remote device 110 downloads the HAVi applet 238 from the intermediate device 130. The Havlet may be simple, for instance, only allowing control of (part of) the intermediate device 130. Advantageously, the Havlet enables the user to control several A/V devices and provides a suitable user interface for several A/V devices. In this way a user can access A/V devices remotely while still using the user interface familiar from controlling the devices at home. For enabling the downloading of the Havlet from the intermediate device 130 to the remote device 110, advantageously the intermediate device 130 is equipped as an HTTP server. The functionality required for this is well known and not described further. By using the HTTP server, the remote device 110 can simply access and retrieve the Havlet 238 using standard protocols and widely available software.

In a further embodiment, the intermediate device is capable of downloading the HAVi applet 238 from one of the other devices in the in-home network 140. In this way, for instance a user interface and/or control application program of a VCR, written in portable code, can first be downloaded (or uploaded) to the intermediate device (like a PC or set top box). The functionality for loading a Havlet is standard available in a specific class of HAVi devices, referred to as Full AV device (FAV). Next, the program is loaded into the remote device (for instance located in an office), allowing control of the VCR in exactly the same way as if the user directly operated the device. Also the same user interface may be supplied.

As an alternative to downloading the applet from or through the intermediate device 130, the applet may also be retrieved from any other suitable location. For instance, the manufacturer of CE devices could make available (e.g. on its Internet site) downloadable programs for controlling its CE devices. The applet may also be incorporated in programs, like an Internet browser, already present in the remote device 110.

It will be appreciated that the HJA emulator 310 and the module 330 need only be developed once. If they support the full functionality of the HAVi API, they can be used to let any Havlet execute on a remote device. As an alternative to a full-blown HJA emulator 310 or module 330 also restricted implementations may be used, which only provide the functionality required for the specific Havlet 238. In this scenario preferably the HJA emulator 310 is loaded together with the Havlet 238 in the remote device 110. The intermediate device loads the module 330 that corresponds to the Havlet 238.

The HJA has different types of classes:

- Classes that can be implemented in a platform independent way.
- Classes that cannot be implemented in a platform independent way.

In practice, quite some HJA classes on the FAV itself (especially for the L2 User Interface functionality) will be mostly implemented in a proprietary way to make them as efficient as possible. When uploading of a Havlet onto a non-HAVi device 110, the non-HAVi device has to provide the HJA to that Havlet by using the HJA emulator 310. The user interface is typically then executed locally on the remote device. The HJA emulator 310 can simply provide the UI part of the HJA by using an implementation built on Sun's Java AWT (Abstract Windowing Toolkit). The AWT package is normally available on most Internet devices (PCs with Java). For the non-UI part of HJA, i.e. the access to the HAVi infrastructure, all HAVi Java classes can be implemented in a platform independent way, with the exception of the Software Element class, and classes in the org.havi.iec61883 package. This subdivision of the HJA functionality is shown in Figure 3. The total set of functionality is indicated by 400, the UI related part by number 430, the part which can be implemented in a device independent way by number 420, and the part which is device dependent by number 410.

As described above, the remote device in addition to downloading the Havlet 238, also has a choice in obtaining the HJA emulator 310. For instance, the remote device could:

- Build it into the browser
- Upload it from a web site
- Upload it from the HAVi intermediate device, or through the HAVi intermediate device from one of the other HAVi devices in the in-home network

Such an option may be chosen for the entire HJA emulator, but a choice may also be made independently for the HJA components indicated in Figure 3 (the UI part, the platform independent and dependent packages).

CLAIMS:

1. A communication system including an in-home network and a remote device;

the in-home network including a plurality of in-home devices operative to communicate using a predetermined in-home application protocol; one of the in-home devices, being referred to as intermediate device, also being operative to communicate with the remote device; the intermediate device and the remote device using communication protocols, referred to as remote protocols, which differ from the in-home application protocols;

the remote device being operative to:

load a portable application program for controlling at least one of the in-home devices using the in-home application protocol;

load an API emulator operative to:

emulate an API which provides an interface for the application program at least for those functions of the in-home application protocol that are used by the application program; and

communicate with a module in the intermediate device;

the intermediate device including an API which provides interface functionality for at least those functions of the in-home application protocol that are used by the application program; the interface functionality being provided by controlling the intermediate device an/or communicating with other in-home device(s) according to application messages of the in-home application protocol; the intermediate device being operative to load the module for enabling communication between the API emulator in the remote device and the API loaded in the intermediate device, establishing a substantially transparent communication path between the portable application program in the remote device and the API in the intermediate device.

2. A communication system as claimed in claim 1, wherein the in-home application protocols are HAVi based.

3. A communication system as claimed in claim 1 or 2, wherein the portable application program is Java based.

4. A communication system as claimed in claim 1, 2, or 3, wherein the remote protocols are based on Internet protocols.

5. A communication system as claimed in claim 1, 2, 3, or 4, wherein the remote device is operative to load the portable application program and/or API emulator from the intermediate device.

6. A communication system as claimed in claim 5, wherein the intermediate device is operative to load the portable application program and/or API emulator from an in-home device other than the intermediate device.

7. A method of communication in a communication system including an in-home network and a remote device;

the in-home network including a plurality of in-home devices operative to communicate using a predetermined in-home application protocol; one of the in-home devices, being referred to as intermediate device, also being operative to communicate with the remote device; the intermediate device and the remote device using communication protocols, referred to as remote protocols, which differ from the in-home application protocols;

the method including:

loading in the remote device:

a portable application program for controlling at least one of the in-home devices using the in-home application protocol;

an API emulator operative to:

emulate an API which provides an interface for the application program at least for those functions of the in-home application protocol that are used by the application program; and

communicate with a module in the intermediate device;

loading in the intermediate device a module for enabling communication between the API emulator in the remote device and an API loaded in the intermediate device; the API providing interface functionality for at least those functions of the in-home

application protocol used by the application program; the interface functionality being provided by controlling the intermediate device an/or communicating with other device(s) in the in-home network according to application messages of the in-home application protocol, establishing a substantially transparent communication path between the portable application program in the remote device and the API in the intermediate device.

ABSTRACT:

A communication system includes a HAVi-based in-home network 140 and a remote device 110 operative to communicate with an intermediate device 130 of the in-home network via Internet. The remote device loads a HAVi applet (Havlet) 238 for controlling at least one of the in-home devices using HAVi. The remote device also loads an HAVi API (HJA) emulator 310 which emulates HJA. The HJA emulator provides an interface for the Havlet and communicates with a module 330 in the intermediate device. The intermediate device includes the actual HJA 236 which provides the actual interface functionality for the HAVi functions used by the Havlet. The interface functionality is provided by controlling the intermediate device an/or communicating with other in-home device(s) according to application messages of the in-home application protocol. The intermediate device loads the module for enabling communication between the HJA emulator in the remote device and HJA loaded in the intermediate device, giving a substantially transparent communication path between the portable application program in the remote device and the HJA in the intermediate device.

Fig. 2B

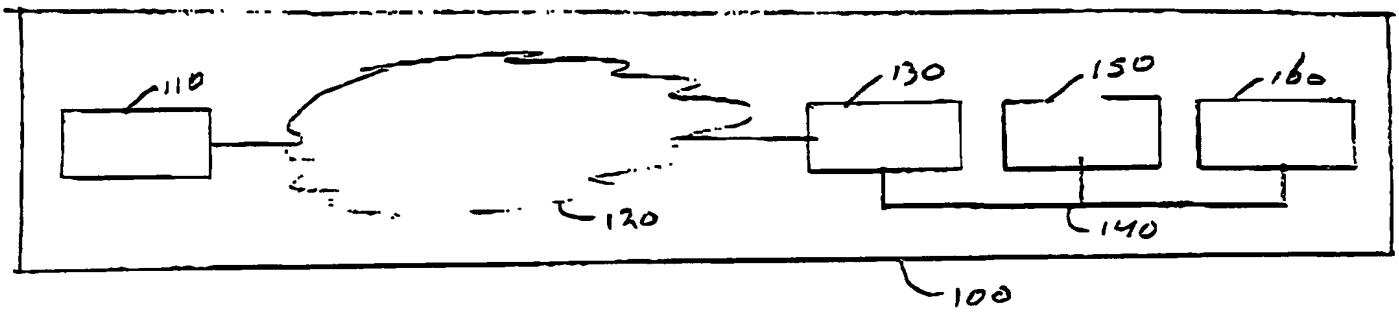


Fig 1

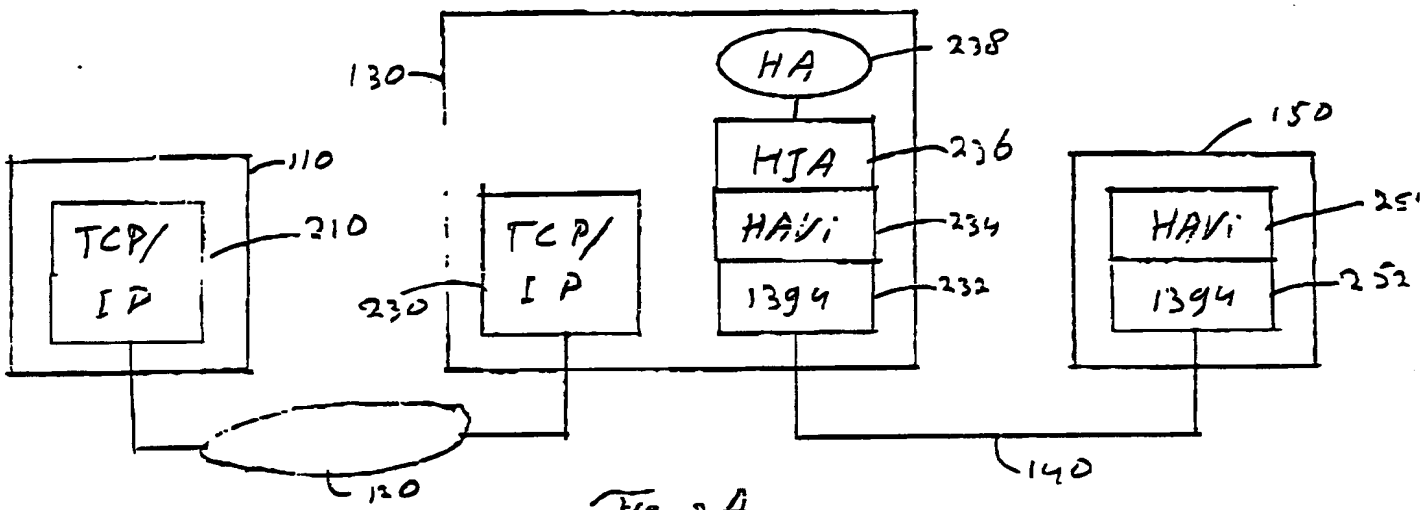


Fig 2A

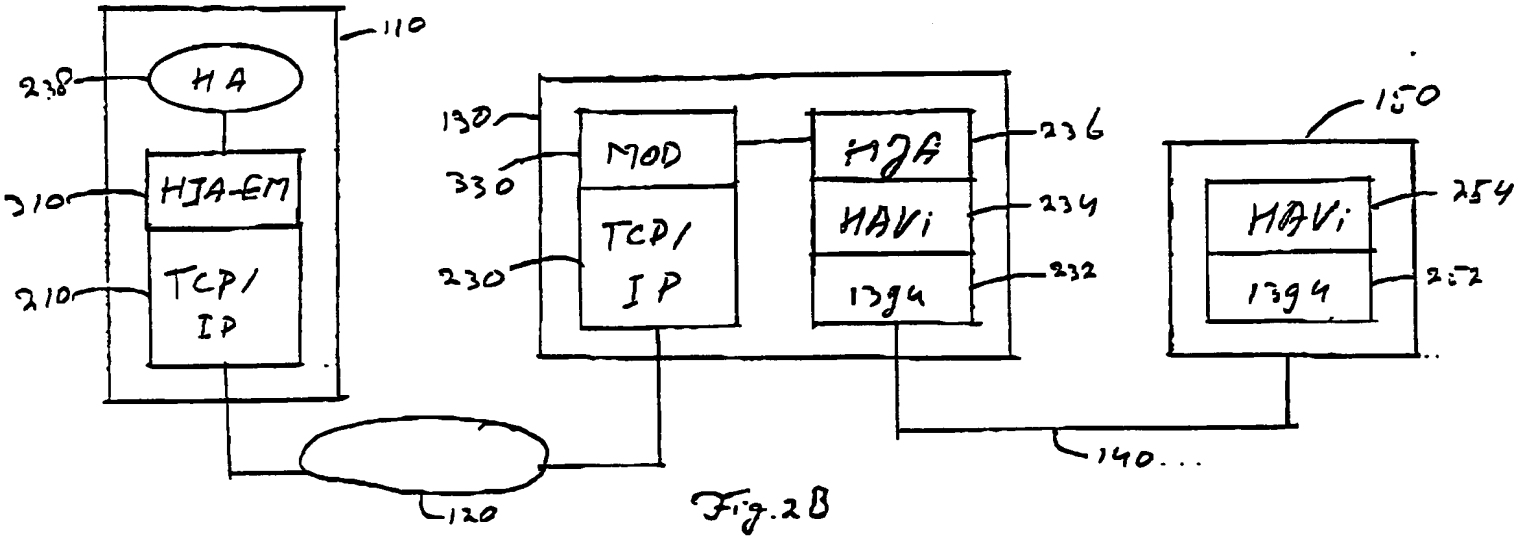
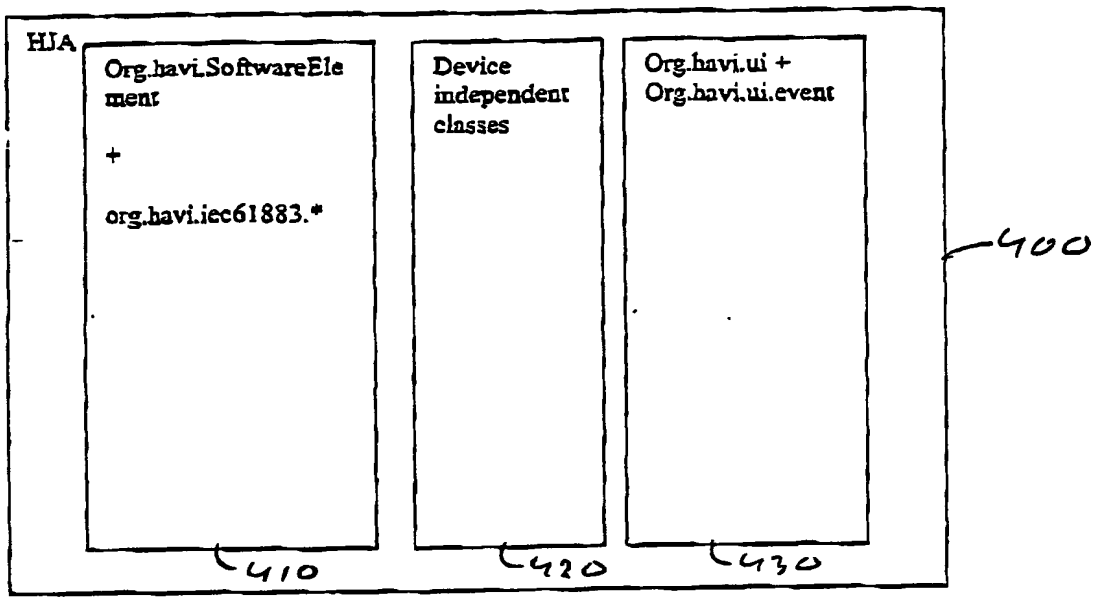


Fig.2B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400
410
420
430

Fig. 3